Development of an Expert system for Tank model by using visual basic

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Abstract

Combined systems (CS) as new emerging technology are becoming increasingly useful. In the last two decades many mathematical models for water resource analysis were developed mainly by conventional programming using a high level language as FORTRAN and C programming . Due to the fast progress in the computer technology, the application of artificial intelligence and expert systems enhances capability of the water numerical models. This paper discusses a CS of numerical models and expert system for the development of a decision support system for the water resource management of Fukuoka City including an application of the rainfall runoff analysis by tank model.

Introduction

Planning and management within a water resource utilities may take a considerable time. The past and traditional approaches for policy modelling have focused mainly on the analysis of alternatives rather than the generation, exploration and synthesis of alternatives. Figure 1 is such a simplified illustration of typical past and even some current attempts of comprehension models and applications. The essence of the modelling process revolves around the potential users (decision makers, analysts or managers) and the comprehensive simulation and/or optimization model. As shown in Figure 1 the application of the models for several trial and the access to the appropriate data base are weakly linked and the use of the resulted policy and scenario as a new data base is hardly used in many cases.

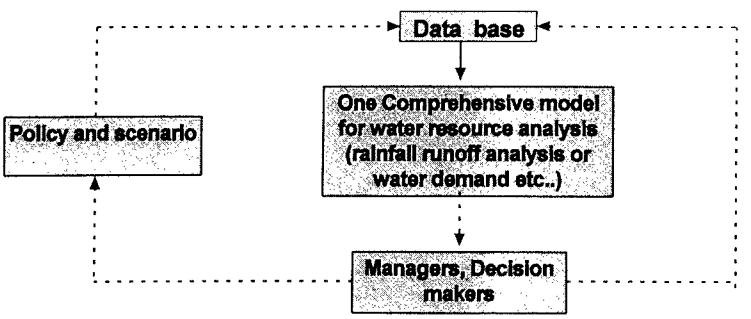

Figure 1 Typical relationships among policy makers, their models and data base

Any approaches to overcome such difficulties and limitations found in the past models should recognize the need to involve an expert system menu as a visual interface. The interactive interface system needs to be integrated in order to make models easy to understand and to permit an easy interaction between the users and the water resource model. The input data and editing should be easily managed for comprehension of the fundamental characteristics of the data .

The frame of water resources management (DSS)

Rainfall runoff analysis by tank model is developed as a part of highly integrated Decision support system (DSS) of the water resource management of Fukuoka City in Kyushu Island, Japan. The model of the runoff process is involved in the DSS through an expert system menu written in Visual Basic.

Figure 2 illustrates how a model management or decision support system differs from the approach illustrated in Figure 1. The focus is broader and not only includes models and policy analysts, but also reflects the interactive policy making process. Figure 2 emphasizes the interaction of managers, planners and policy makers with various decision and prediction models linked with appropriate data base. User can get the function which allow to explore, define and synthesize various of management or policy operations at real time planning through this system. Although Figure 2 is oversimplified, as Figure 1, but their comparisons demonstrate the fundamental difference in modelling philosophy.

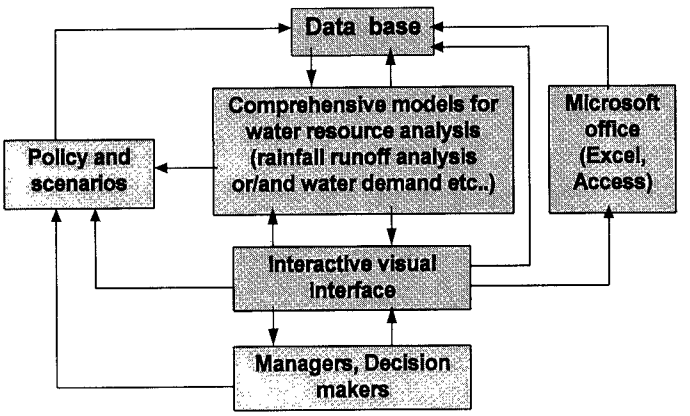

Figure 2- Interactive relationships among policy makers, their models and data base

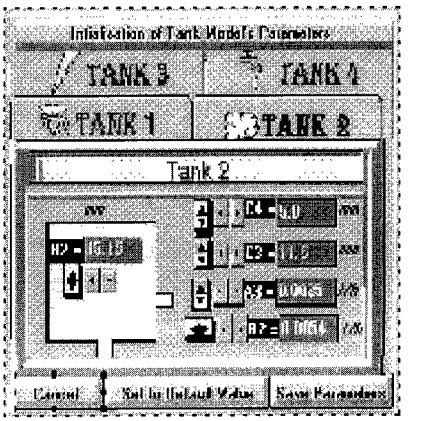

Figure 3 Parameters identification

The interactive visual interface permits to update tank parameters for the characterization of the catchment area Figure 3 and select an appropriate period from the data base Figure 4. The Characterization of the catchment can be done for all the reservoirs in one time Before running the water model written in FORTRAN and display their appropriate result on the screen. The obtained result (graphs and tables) are kept and can be compared with the following trial. Each of the described steps can be repeated for different scenarios by simple click on several buttons. In addition to the above structure, the data base, the obtained scenarios and result can be displayed by interaction with Microsoft Access And Microsoft Excel as shown in Figure 2.

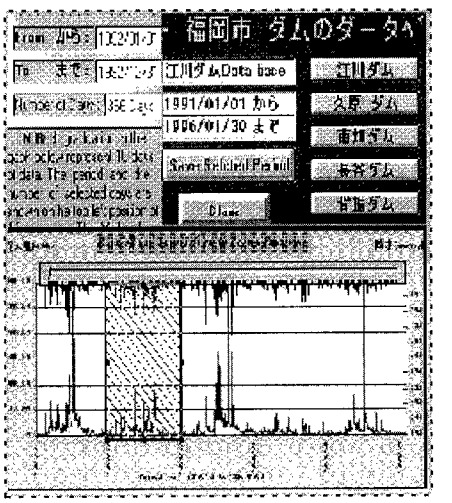

Figure 4 Selection of the data base

Conclusion

The current revolution in the development of mini and microcomputers and interactive computer languages (software) makes possible for any users to have access to fast and inexpensive interactive computer power, supplemented increasingly by colour display capabilities if desired. Tank model for rainfall runoff analysis is presented as a part of an integrated decision support system of the water resource management of Fukuoka City. The extended facilities of the developed software will surely increase its utility to planners and policy makers.